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ABSTRACT

The purpose of this study was to determine if there would be a significant difference in the achievement levels of two groups of eighth-grade Algebra I students when one group receives instruction from a non-traditional (Saxon) method of instruction, and the other receives instruction from a traditional method (Fair and Bragg text). The study was conducted at Oceana Middle School in Oceana, West Virginia, and Glen Rogers Grade School in Glen Rogers, West Virginia during the first 9-week period of the 1996-97 school year. Thirty-three students participated in the study. Nineteen Algebra I students at Oceana Middle School served as the control group. Fourteen students at Glen Rogers Grade School were the experimental group. The classes were held at the same time and had the same amount of instructional time per day. A pretest was given on the first day of class. After 45 days of instruction, a post test was given. Both tests consisted of concepts covered in both textbooks. A two-sample t-test was performed on both sets of data as well as the difference between the scores from the pretest to the post test in both groups. The results indicated that there was statistical difference in the two groups at the beginning of the study. The control group scored much higher than the experimental group but on the post test, results indicated no statistical difference between the two groups. The experimental group improved approximately 65% more than the control group. (Author/ASK)

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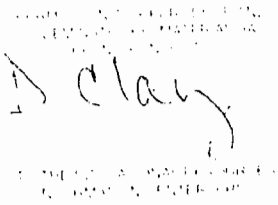
A STUDY TO DETERMINE THE EFFECTS OF A NON-TRADITIONAL APPROACH TO ALGEBRA INSTRUCTION ON STUDENT ACHIEVEMENT

A Thesis

Presented to

The Faculty of the Master of Arts Degree Program

Saiem-Teikyo University



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In Partial Fulfillment

of the Requirements for the Degree
Master of Arts in Education

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by

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This thesis submitted by Donald Wayne Clay has been approved meeting the research requirements for the Master of Arts Degree.

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The purpose of this study was to determine if there would be a significant difference in the achievement levels of two groups of eighth-grade Algebra I students when one group receives instruction from a non-traditional (Saxon) method of instruction, and the other receives instruction from a traditional method (Fair and Bragg text). The study was conducted at Oceana Middle School in Oceana, WV, and Glen Rogers Grade School in Glen Rogers, WV during the first nine-week period of the 1996-97 school year.

Thirty-three students participated in the study. Nineteen Algebra I students at Oceana Middle School served as the control group. Fourteen students at Glen Rogers Grade School were the experimental group. The classes were at the same time, and had the same amount of instructional time per day. A pretest was given on the first day of class. After forty-five days of instruction, a post test was given. Both tests consisted of concepts covered in both textbooks.

A two-sample *t*-test was performed on both sets of data, as well as the difference between the scores from the pretest to the post test in both groups. The results indicated that there was a statistical difference in the two groups at the beginning of the study. The control group scored much higher than did the experimental group. But, on the post test, the results indicated no statistical difference between the two groups. The experimental group improved approximately 65% more than did the control group.

CONTENTS

CHAPTER ONE

INTRODUCTION

I. Background

During the past several years, much has been made of the perceived "failure" of the American educational system. Standardized test scores have fallen from previous achievement levels, and it seems that each year brings a new study by a panel of experts at some educational think-tank located at a prestigious university, or a report by an esteemed educational expert containing important new facts pointing to the total demise of the American culture as we knew it. Usually, the blame is placed squarely on the shoulders of the "crumbling" public educational system. Each new pronouncement of our impending doom is met with much teeth-gnashing and finger-pointing. A blue-ribbon panel is promptly convened to find the solution for the "staggering" problems facing our youth. Usually, many months, or even years, go by with little or no attention paid to the findings or recommendations of these "cure-all" committees. Then, a different study finds a new set of "totally unacceptable" problems, and the grand cycle is started all over again.

In the early 1980's, an Algebra teacher in Oklahoma, John Saxon, decided to try to address some of the shortcomings that he perceived to be present in the traditional approach to teaching advanced mathematics courses. Frustrated in his teaching experiences at a junior college, Mr. Saxon concluded that the methods and textbooks were the source of the problems (Johnson & Smith 1987). Traditionally, review in math has been done in a spiral, or periodic format. Topics are presented, with periodic reviews of previous topics. Mr. Saxon felt that this method does not allow time for the assimilation of the new topic. Before a student grasps a new concept, a different one is introduced (Saxon, 1982).

Mr. Saxon's approach is one of continuous review. Only three or four problems in one of his lessons are on the new topic. The other 25 are reviews of already introduced concepts. His intent is to provide, in every problem set, elements of all previously learned material (Johnson & Smith, 1987). This continuous review permits an incremental development of concepts. Basic parts of concepts are introduced and practiced for four or

five lessons before another facet of the same topic is introduced. These are practiced for several more lessons before another skill is introduced. In this manner, learning is spread out, and students slowly grasp the concepts presented to them (Saxon, 1982). The result of Saxon's efforts is a three-volume set of textbooks based, not on a particular grade level, but on a group of skills. Mr. Saxon's approach was met with mixed reviews from within the educational community. No one would even publish his new books, so he eventually started his own publishing company to get them on the market. His report of an *average* of 159% gain on all tests of his experimental group over the control group was astounding (Saxon, 1982). Other studies have reported less dramatic, but still solid, improvements (McBee, 1984). His text initially was met with much skepticism, but seems to slowly be gathering support from teachers who use it.

II. Statement of the Problem

Many theories have been advanced regarding how to better educate American math students. The purpose of this research is to see if a significant improvement over traditional Algebra instruction can be achieved by using Saxon's Algebra I: An Incremental Development. Two groups of students will receive Algebra instruction over a period of nine weeks. Evaluation of one group receiving traditional Algebra instruction will be compared to another group receiving instruction via Saxon's incremental method. This evaluation will be through the use of both a pretest, to measure existing knowledge, and a post test, to measure the cognitive advances made during the duration of the research project.

III. Purpose of the Study

For years, educators have varied methods of instruction in an effort to better address the many learning styles encountered every day in their classrooms. The purpose of this study is to compare two methods of teaching in Algebra I classrooms. Emphasis is placed on the effect a non-traditional method of Algebra instruction will have on student learning of Algebra.

IV. Research Question

The following research question is examined in this study:

Does the use of a non-traditional Algebra method have a statistically significant effect on the achievement level of the learner when compared to a more traditional method?

V. Significance of the Study

In order to better prepare students for the rigors of higher level mathematics, and the application of concepts to everyday situations, it is important that educators know which types of instruction work best. These methods can be applied in the best manner possible when it is known which instructional method is best suited for each type of student, or what type of material should be taught to those students. Students bring many learning styles to the classroom. Perhaps there is a broad-based method of instruction that can teach a majority of these learners. This study is to help decide if a new type of Algebra instruction is better suited to eighth-graders than the traditional approach.

VI. Definition of Terms

The following terms are advanced for the purposes of this study:

Saxon Text- Algebra I; An Incremental Development. Second Edition, Saxon Publishers, 1990. Algebra I textbook developed by John Saxon. Developed as an alternative to the "traditional" approach. Stresses practice of skills learned and repetitive use of topics covered in every practice set.

Fair and Bragg Text- Prentice Hall Algebra I. Prentice Hall, Inc., 1991. Jan Fair and Sadle Bragg. Algebra I text that follows the "traditional" method. Topics are introduced, practiced, and usually not used again until either a review section or on a test.

control group- group of nineteen eighth grade Algebra I students at Oceana

Middle School in Oceana, WV. This class was taught using the traditional spiral-type method of algebra instruction. The class is during first period.

experimental group- group of fourteen eighth grade Algebra I students at Glen Rogers Grade School in Glen Rogers, WV. This class was taught using the Saxon method of instruction. The class is during second period.

pretest- locally developed, criterion-based, twenty-five question test covers the concepts introduced in both the first twenty-five lessons in the Saxon Text, and in the first two chapters of the Fair and Bragg Text.

post test- locally developed, criterion-based, twenty-five question test covering the concepts introduced in both the first twenty-five lessons in the Saxon Text, and in the first two chapters of the Fair and Bragg Text.

traditional method- method of instruction used by most mathematics textbooks, in which concepts are introduced one at a time, with practice problems on each concept done at that time. The concepts are not usually practiced again until a review session, or some test calls for them to be used.

non-traditional Saxon method- method of mathematics instruction in which concepts are introduced one at a time, but only three to four practice problems are done at that time. All other problems on that day's assignment are to practice previously acquired skills. This allows for a firm foundation on which to build understanding. Concepts are practiced for some time before the next one is introduced. Learning is spread out, not concentrated. The purpose is to constantly reinforce the skills already introduced.

VII. Limitations of the Study

The following limitations are recognized in this study.

1. Because random sampling for these groups is not possible, these findings may not generalize to students in other locations.
2. Because the sample is small, differences in scores may not reach levels of significance.
3. The bias of two different teachers could affect the validity of the study.
4. The cultural and socioeconomic status of the sample could cause the findings to not generalize to students outside this geographic region.
5. The possible loss or gain of students in the sample during the time frame of the study could affect the validity of the study.
6. This study is limited to eighth-grade Algebra I students (n=33). These students are divided into a control group (n=19), and an experimental group (n=14). The smaller size of the experimental group alone could result in better performance.
7. This study is limited to nine weeks in duration.
8. This study is limited to topics covered in both the first twenty-five lessons of the Saxon Text, and the first two chapters of the Fair and Bragg Text.

CHAPTER TWO
REVIEW OF THE LITERATURE

The idea for this study came from the ongoing debate as to whether the traditional approach to Algebra could be improved. Higher test scores and a better understanding of the concepts involved are the goals anytime that a new method is introduced into a field of study. The educational community is constantly trying to upgrade its methods, its message, and ultimately, its product. Sometimes, changes are implemented for changes sake. At other times, stubbornness prevents new methods from being introduced. The ultimate goal is to better prepare our students for the rigors of learning higher math skills, and in turn, to deal better with real-life situations. The purpose of this study is to help determine whether or not a different approach to instruction in Algebra will make a difference in the understanding of the concepts involved.

American students are constantly compared to students from around the world. As the global community gets smaller and demands placed on young people become more technical, young Americans will compete more directly with foreign students for the same jobs, in the same marketplace. American students need the best possible education, so that they can better compete for these jobs. If America is to remain a leader of the world, then it is imperative for our educational system to lead the way. Studies like this one help to address the issue of which type of delivery system is best for a part of that essential education.

Today's technological world demands a higher level of mathematical knowledge than ever before. Basic jobs now require the use of computer skills. This new age of job skills demands a higher level of mathematical training than ever, also. To reach these higher skill levels, new approaches to traditional subjects have been advanced. Some of these approaches have been met with skepticism, while others have been endorsed as sound practices. Research on these "new" methods is necessary to evaluate their merits. Educators are constantly searching for "better" methods to use in their efforts to meet the needs of their students as they head toward the new, technological world. As a teacher of

some of these young students, the researcher is constantly trying to upgrade the quality of his teaching methods. In the spring of 1996, the researcher was introduced to the Saxon method of instruction. As it was totally different from any textbook used before by the researcher, simple curiosity dictated that this study be done. Any method with such amazing results deserves to be tested to see if those can be duplicated by other teachers in different areas of the country.

Some research on the subject of Algebra instruction has been published. These studies have been evaluated by the researcher, and a synopsis of each is included here.

Several other types of instruction have been tested against the traditional, spiral-type method of instruction. Robinson found a slight improvement in Algebra test scores when students were taught using a self-paced lab approach (Robinson, 1990). This was a comparison between traditional, lecture-type Algebra instruction, and a more hands-on type approach involving the use of a math-lab and individualized, self-paced instruction. The subjects were students who needed developmental pre-college algebra at Brenau College in Gainesville, Georgia during the fall of 1989. Robinson found that students' mean scores were approximately 39% higher if they learned through a non-lecture type format.

Wilkins found that utilizing a problem-solving approach to Algebra resulted in higher scores on a standardized test (Wilkins, 1993). Her study involved eighth-graders enrolled in Algebra I. Various teaching strategies, including games, manipulatives, group activities, and projects were employed to present concepts from Algebra in a "different" manner than is usually the case. This study took place in 1991 and 1993. In 1991, some eighth-graders (n=56), were taught seven skills traditionally and four skills via the problem-solving approach. Other students (n=18), were taught all skills traditionally. The scores of the four problem-solving skills were significantly higher than the seven skills taught traditionally. In 1993, some eighth-graders (n=51) were taught all skills via the problem-solving method and the remaining eighth-graders (n=44) were taught all skills traditionally. There was no significant difference between the scores of the two groups. However, the scores for the skills taught traditionally in 1991, but via the problem-solving

method in 1993 increased significantly (Wilkins, 1993). The scores for the traditionally taught skills did not rise significantly. The problem-solving method seems to have resulted in higher test scores.

In 1981, an Algebra teacher in Oklahoma, John Saxon, printed his findings on his then unpublished textbook, which he had compared to a traditional Algebra textbook (Saxon, 1981). He used 1,360 ninth-grade algebra students as his test subjects. They were all students in 20 Oklahoma public schools. They took the California Achievement Test (CAT) in mathematics (level 18C) to establish their initial capabilities and preparedness. The book used in the control group was the one normally used in each student's school. The same teachers taught control and experimental groups at each school. The CAT was administered in August. Between February and May, 16 more tests were given to all students. The test scores were grouped according to the August CAT scores as low (below the 44th percentile), low-medium (45th to 63rd percentile), high-medium (64th to 78th percentile), and high (above the 78th percentile). His findings were astounding! He reported an *average* of 159% increase on each of the 16 tests administered to his experimental group of 541 students over the control group of 841 students taught from the traditional textbook. His findings were not well-received, and he had to finally form his own company to publish his textbooks. No one has been able to duplicate the astounding results that Mr. Saxon claimed, but most attempts have shown his method to produce at least moderate improvement over traditional instruction.

Klingele and Reed conducted a similar study in the fall of 1982. They chose remedial Algebra students at the University of Arkansas. The scope of their study was slightly smaller (n=595), than Saxon's. This study lasted for a period of one semester. Their findings were not nearly as striking as those reported by Saxon, but the difference was significant. Before instruction, scores on the American College Testing (ACT) Program mathematics subtest were compared. No significant difference in the mean scores of the two groups was found. Achievement was measured by three methods: the departmental final exam, the Basic Algebra Test, Form 1B, developed by the Mathematics Association of America, and the Shatkin Mathematics Opinionnaire. The latter test was

used to measure attitudinal change within each student. It was administered at the beginning and at the end of the semester.

After instruction, a significant difference in achievement was found. On the department final exam, the Saxon group outperformed the control group by approximately 24%. On the Basic Algebra Test the experimental group scored approximately 22% better than the students in the control group. The scores on the attitude opinionnaire found no significant difference between the two groups after instruction (Klingele & Reed, 1984).

A 1984 comparison between the Saxon method and a traditional method using the Dolciani text was conducted by McBee. This test (n=165), was conducted in seven public high schools in Oklahoma City, Oklahoma in 1984. This study lasted for a whole school year. Once again, the same teacher taught two different classes, one with the Dolciani text, and the other with Saxon. Results of an Algebra I Comprehensive Exam were compared, and the Saxon group outperformed the Dolciani group as a whole. The test included twenty-one topics, with the Saxon group clearly outperforming the Dolciani group on eleven of the topics. Additionally, the performance of the Saxon group was close to being significantly higher on four other topics. There was no difference in performance on five tests, and the Dolciani group outperformed the Saxon group on only one test. In addition, six of the seven teachers who participated in the study preferred the Saxon text. Statistical tests were also performed on the data to see if there was a difference in the levels of achievement according to students' ability levels. Students were grouped according to their score on the spring 1980 California Achievement Test. At each ability level, the Saxon students outscored the Dolciani students on the Algebra I Comprehensive Exam (McBee, 1984).

Another reference compares the Saxon method with a traditional one using the Holt text. This does not exactly fit within the concepts addressed in this study, however, the Saxon *method* is examined. A group (n=190) of second and third graders in Batesville, Arkansas was used for the study. It was found that students scored significantly higher on the Stanford Achievement Test if they had been taught with the Saxon method (Calvery, 1993). Additionally, this study advances support for the fact that

underachieving students can reduce the gap in math achievement by using the Saxon method of instruction. According to the SAT pretest, the Saxon group started behind the Holt group in math achievement. This suggests, perhaps, that the method is successful across a broad spectrum of ages, and that further study is needed.

An Oklahoma study performed by Johnson and Smith, however, shows that not everyone has been able to reproduce Saxon's results. This study (n=276) was done during the 1985-86 school year in Oklahoma. Six teachers taught two classes each, one using the Saxon text, and the other with the Dolciani text. Achievement was assessed by the Comprehensive Assessment Program High School Subject (Algebra I) Tests (CAP). The results showed no significant difference in achievement. In fact, in Definitions and Theory, the Saxon students scored lower than the Dolciani students. However, the results also showed that the Saxon text was preferred by a majority of teachers (five of six). It also was very popular with the students who used it (Johnson & Smith, 1987).

Since none of the evidence examined seems to conclusively show if the Saxon method works, it seems incumbent that more research should be done in this area. An extensive search of the Educational Resources Information Center (ERIC), yielded little additional information on this topic. This lack of information suggests a need for more research into this topic. If one method of delivery for Algebra is, indeed, better than others, then it is reasonable that this method be employed, to better prepare students for their Mathematics careers.

This study attempts to help fill the void in this area, point the way for future research, and provide additional insight into an ongoing debate about the future of Mathematics instruction. It seems that, as educators, we are slow to embrace "different" methods, unless it has been proven beyond a shadow of a doubt that they will work. This researcher acknowledges this need for validation, and hopes to examine this "different" method for evidence of success.

CHAPTER THREE
METHODOLOGY

I. Description of Population

This study compares the effects of using a non-traditional Algebra method of instruction with the achievement of a similar group using a more traditional method.

A total of 33 eighth-grade Algebra I students were used for the purposes of this research. Nineteen students enrolled in Algebra I at Oceana Middle School in Oceana, West Virginia, served as the control group. Fourteen eighth-graders at Glen Rogers Grade School, in Glen Rogers, West Virginia, were the experimental group. This sample was not randomly chosen for these classes. At Oceana, all students who enrolled in Algebra I participated. These were all eighth-graders in regular education, who chose to enroll in Algebra I. There were several other students taking regular (non-Algebra) mathematics classes. At Glen Rogers, all regular eighth-grade students participated in the Algebra I class. This school is smaller than Oceana, and there were no other regular eighth-grade students taking any mathematics classes.

The control group consisted of ten females and nine males. The experimental group had six females and eight males. All sample members lived in their respective communities. The research may not be able to be generalized to other areas of the country because of the limitation in sample selection.

II. Hypothesis

The null hypothesis states that there is no significant difference at the .05 level in the achievement levels of the two groups, when one receives instruction from a traditional method using the Fair and Bragg Algebra I textbook, and the other receives instruction from the non-traditional (Saxon) method using the Saxon Algebra I for a period of nine weeks.

III. Instrumentation

This research involved the use of a pre- and post test. A locally designed, criterion-based test was used in both cases. These tests were developed from the concepts covered in *both* the first twenty-five lessons of the Saxon text, and the first two chapters of the Fair and Bragg book. Both pre- and post tests consisted of twenty-five short-answer questions, and covered the same concepts. Different forms of the same type question were utilized on both tests. All questions were approved by the instructors involved in the study.

The Saxon text requires a developmental approach, so it does not lend itself to easy movement from one section of the book to another. Since the Fair and Bragg book lends itself more readily to movement within topics, all the concepts chosen to be covered came from the first sections of both books.

IV. Research Design

This study is designed to evaluate whether a traditional or a specific non-traditional approach is better for teaching Algebra I to eighth-grade students.

Internal reliability was achieved through the administration of a pre- and post test that accurately measured the cognitive level attained from the instruction received during the course of this study. This involved the use of a locally designed criterion-based test. The researcher scored both tests in order to maintain reliability. The bias of the researcher in scoring the tests could jeopardize the generalization of results to the population of Algebra I students.

A two-sample *t*-test was performed on the results of each test to determine if there was a significant difference at the .05 level in the achievement of both groups. The dependent variable was the difference in level of achievement between the pretest and the post test. The independent variable was the type of instruction received during the course of the study. However, selection bias could jeopardize the generalization of results to the population of Algebra I students.

Every attempt was made to maintain the equivalence of these groups at all stages

of the study. Constants present in this research included time, length, and days of instruction. Also, the mathematics concepts covered included the ones tested for both groups.

Several variables were present in the research. Class make-up by gender, ability level, motivation level, and existing knowledge cannot be controlled.

V. Data Collection Protocol

Data collection occurred at two times during the length of this study. A pretest was given on the first full day of instruction in each group. This test consisted of 25 short-answer questions. The instructor did not offer assistance and gave only one, one-hour class period for the students to finish the pretest. Tests were collected and scored by the researcher. Bias could have entered into the study at this point. A two-sample *t*-test was performed on the results to determine if an initial significant level of difference existed between the two groups.

After nine weeks of instruction, or approximately forty-five hours, a post test of 25 short-answer questions was administered to both groups. Administration followed the same procedure as during the pretest. Only one, one-hour class period was used to complete the test. Again, the researcher scored both tests to maintain reliability. At this point, bias could again enter into the study. Another two-sample *t*-test was performed on the results to see if a significant difference existed at the .05 level.

In addition, a two-sample *t*-test was performed on the differences between the scores of the two tests in each group. This will allow an insight into which group actually developed the most cognitive ability during the length of the study.

VI. Data Analysis Procedures

The following hypotheses was investigated in this study; H_0, the null hypothesis, for the pretest data was that there is no significant difference at the .05 level in the achievement levels of the two groups on the pretest. H_1, the alternative hypothesis, was that there is a significant difference at the .05 level in the achievement levels of the two

groups on the pretest. H_0 for the post test data was that there is no significant difference at the .05 level in the achievement levels of the two groups on the post test. H_1 for the post test data was that there is a significant difference at the .05 level in the achievement levels of the two groups on the post test. H_0 for the difference between the pre- and post test scores was that there is no significant difference at the .05 level in the achievement levels of the two groups between the two tests. H_1 was that there is a significant difference at the .05 level in the achievement levels of the two groups between the two tests.

Data collected from this research was analyzed with two-sample *t*-tests to see if a significant difference exists at the .05 level. The scores from the pretest, the post test, and the differences in those scores were each analyzed. A *t*-score was calculated for each set of scores, and it will be examined to see if it falls within the rejection region at the .05 level for that test. If it does fall within this rejection region, the null hypothesis will be rejected, and the alternative hypothesis will be accepted. If the *t*-score does not fall within the rejection region, the null hypothesis will be accepted.

CHAPTER FOUR
ANALYSIS OF DATA

The purpose of this study was to determine if there is a significant difference at the .05 level in the achievement levels of two groups of eighth-grade Algebra I students when one group is given instruction with a nontraditional method of instruction and the other group is given traditional instruction. The scores on a pretest and a post test, as well as the differences between the two scores were analyzed for significant differences.

I. Results

The results of the *t*-test (independent samples, variances not equal) found the *t*-score for the two groups' pretests to be larger than the critical value of 2.160. Therefore, there was a statistical difference in the performance of the two groups on the pretest. The control group's mean was approximately 137% higher than the score for the experimental group. The results of the treatment of this data are shown in Table 1.

Pretest Two Sample *t*-Test

	N	Mean	St. Dev.	SE Mean
Control Pretest	19	7.95	3.37	0.77
Experimental Pretest	14	3.36	2.10	0.56

Table 1
$t = 4.80$ DF= 13

The results of the *t*-test (independent samples, variances not equal) performed on the scores from the post tests found the *t*-score to be less than the critical value of 2.160. Therefore, we must conclude that there is no statistical difference in the performance of the two groups at the .05 level on the post test. The results of the treatment of the raw data are shown in Table 2.

Post Test Two Sample *t*-Test

	N	Mean	St. Dev.	SE Mean
Control Post Test	19	16.11	3.38	0.78
Experimental Post Test	14	16.79	5.19	1.4

Table 2
t= -0.43 DF= 13

The researcher then compared the differences between the pre- and post test scores for all members of both groups. The *t*-score (dependent samples) for that comparison was less than the critical value of -2.160. There is a significant difference in the achievement of the experimental group over the control group in the improvement in the scores from the pretest to the post test. The improvement of the mean of the experimental group was approximately 65% higher than the improvement in the mean of

the control group. The results of the treatment of the raw data for the improvement in the scores are shown in Table 3.

Differences Two Sample *t*-Test

	N	Mean	St. Dev.	SE Mean
Control Difference	19	8.16	3.72	0.85
Experimental Difference	14	13.43	4.43	1.2

Table 3
t= -3.61 DF= 13

In summary, the purpose of this study was to determine whether there was a significant difference in achievement when one group was given Algebra I instruction with a nontraditional method of instruction and another group was given a more traditional instruction.

The results of this study indicate that on the pretest, there was a significant difference in the performance of the two groups. The control group outperformed the experimental group by approximately 137%. There was no significant difference in the achievement levels of the two groups on the post test. A significant difference was also evident in an analysis of the differences in scores in each of the groups from the pretest to the post test. The improvement in the experimental group's scores was approximately 65% higher than the control group's scores.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

I. Summary

The purpose of this study was to determine if there would be a significant difference in the achievement levels of two groups when one group is given instruction with a nontraditional method of Algebra I instruction and the other group is given traditional instruction.

This study was conducted at Oceana Middle School and Glen Rogers Grade School during the 1996-97 school year. The participants in this study consisted of 33 eighth-grade students enrolled in two Algebra I classes. One class of nineteen students at Oceana Middle School was the control group, and one class of fourteen students at Glen Rogers Grade School was the experimental group. Different teachers taught the two classes. The purpose and procedures of the study were explained to each class. The study lasted for a nine-week period.

The control group was given instruction with the traditional (Fair and Bragg) Algebra I textbook. The experimental group was given instruction with the nontraditional (Saxon) text. Time, length, and days of instruction were the same for both groups.

A 25 question, short-answer pretest that covered the common skills from the first 25 lessons of the Saxon text and the first two chapters of the Fair and Bragg text was given to each group on the first day of class. A two-sample *t*-test was performed on this data, and there was a significant difference in the levels of achievement. The control

group scored approximately 137% better on the pretest than the experimental group. After forty-five days, or approximately 45 hours, of instruction, a similar post test of 25 questions was administered to each group. Again, a two-sample *t*-test was performed on the data, and this time there was no significant difference in the levels of achievement.

Using the scores from the two groups, a *t*-test was performed on the difference between the scores on the pretest and the post test. A significant difference was found in the difference between the pre- and post test scores. The experimental group performed approximately 65% better than the control group in the difference between the scores at the .05 level.

II. Conclusions

There has been much concern about falling math scores on standardized tests, college entrance exams, and other methods of measurement. Many different theories advance reasons for these scores. This study attempts to add information to the debate over mathematical instruction. Some people feel that a "different" method of instruction would improve levels of achievement.

The results of this study seem to indicate that this "different" method does make a significant difference on student achievement in Algebra I. While no significant difference was found in the post test scores, the pretest scores indicate that the control group had a higher level of understanding at the beginning of the study. At the conclusion of the study, the experimental group's scores were statistically the same as the control group's. This would seem to indicate that the experimental group "learned" more during the course

of the study than did the control group between the pre- and the post test. This would tend to agree with the Calvery study of second and third graders, in which the Saxon group started behind the Holt group. By the end of that study, the Saxon group scored significantly higher on the Stanford Achievement Test (Calvery, 1993).

III. Recommendations

Recommendations for further studies would include a survey of attitudes of both students and teachers prior to, and at the conclusion of, the study. This could be effective in determining the level of satisfaction with traditional and nontraditional textbooks. A positive teacher or student attitude toward a particular type of book could create a positive influence in the mathematics classroom.

This study would indicate a need for further research to determine which type instruction best meets the needs of underachieving students. The results of this study seem to show that the nontraditional method works well with that group. The experimental group started at a level of achievement behind the control group, but their levels were approximately equal at the end of the study.

A study of longer duration would seem to be warranted. Could the experimental group have continued their progress, and perhaps surpassed the control group's level of achievement?

A final recommendation for further research is the development of evaluation methods that would identify learners by type, and recommend a "best" method of instruction for that student.

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Appendix 1

Test Scores: Control Group

Student #	Pretest Score	Post test Score	Difference
1	6	16	10
2	4	18	14
3	17	21	4
4	9	16	7
5	3	12	9
6	9	21	12
7	4	20	16
8	8	17	9
9	11	17	6
10	11	17	6
11	5	10	5
12	7	9	2
13	7	13	6
14	10	13	3
15	9	18	9
16	7	16	9
17	11	19	8
18	4	17	13
19	9	16	7

Appendix 2

Test Scores: Experimental Group

Student #	Pretest Score	Post test Score	Difference
1	2	21	19
2	1	5	4
3	6	18	12
4	5	21	16
5	3	21	18
6	4	12	8
7	0	13	13
8	4	20	16
9	2	19	17
10	4	11	7
11	2	14	12
12	2	16	14
13	8	24	16
14	4	20	16